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ENTOMOLOGICAL NEWS

NOVEMBER 1947

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Swarm Behavior of Hexagenia atrocaudata in Relation to Temperature and Relative Humidity (Ephermeroptera)

By HERMAN G. COOKE, Department of Biology, Hampton Institute, Hampton, Virginia

INTRODUCTION

In a previous paper [1] an attempt was made to record the swarming phenomena manifested in the behavior of *Stenonema vicarium* at sundown over the banks of Darby Creek near Clifton Heights, Pennsylvania. In a later publication,[2] observations were made on *Isonychia christina* maneuvering at a high altitude a short distance from the same location. As a result of these observations it was reasonable to conclude that a more intensive and thorough study of such behavior patterns would be of interest. Possibly, also, these patterns might be correlated in some degree with genetic relationships.

METHODS

The methods used during both nymphal and imaginal surveys involved a close analysis of the area in order to determine any change occurring among the population. Reluctantly, it was found that the best time for collecting adults in numbers was about 9 o'clock P.M. (E.S.T.), at which time the insects would be circling vigorously about electric lights on the banks of the stream in a nightly performance that lasted for thirty minutes,

[1] COOKE, HERMAN G., 1940. Observation on mating flights of mayflies, *Stenonema vicarium*. ENT. NEWS, 51: 12.

[2] COOKE, HERMAN G., 1942. Mating flights of *Isonychia* mayflies (Ephemeroptera). ENT. NEWS, 53: 249.

after which the insects vanished. Observations throughout the night revealed only scattered individuals returning at random.

The duration of these performances paralleled those indicated for normal flights, but differed widely both in the absence of those graceful movements and in the attempts to copulate that so strikingly characterize active mating. Each summer both nymphal and imaginal collections contained members of the three genera known in the area, namely, *Stenonema, Isonychia,* and *Cloeon.*

The methods used in determining the amplitude of rhythmic movements and their height above the surface of the land or water were as follows: (1) Tags were tacked at known levels on wooden strips that were placed vertically in or beside the stream and allowed to project above the surface of the water or ground over which the maneuvering took place; (2) rolls of tape with tags attached at measured intervals were suspended from the upper branches of trees or nearby shrubs to the water or ground beneath. The average distance reached by the insects while ascending and descending was plotted by reference to these devices.

During observations on flight behavior, it became apparent that the occurrence of swarming depended also upon weather conditions. Since almost nightly visits were made to Darby Creek and records kept, it is possible to study activity with relation to the temperature and humidity records of the weather bureau.

Observations on Temperature

Beginning July 27th, 1942, all searches were temporarily suspended because of a period of heavy rainfall (two inches of rain fell within a thirty minute period) accompanied by high winds lasting for several days. Then, on August 8th, 1942, it was observed that the entire area had been invaded by countless numbers of *Hexagenia* imagines. Although the source of these newcomers was uncertain, nevertheless, advantage was taken of their presence for the purpose of investigating the nature of their swarming behavior.

On August 23rd, at 7:30 P.M., as the thermometer registered 72° F., flight movements were observed over a wide area. On the following two days there was a sharp fall to 64°, and flight activities ceased. This temperature proved to be unfavorable both for swarming and for nymphal emergence in this and in related genera. At the same hour on the 26th, at a temperature

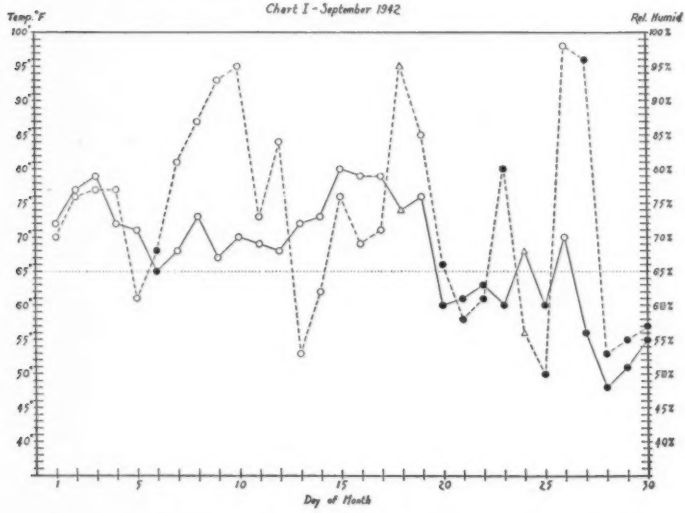

Fig. 1. Records for September 1942. Solid line is temperature; broken line is relative humidity; ○ = activity observed; ● = no activity; ⊗ = no record; △ = rain.

four degrees higher, activity was resumed. This incident revealed the limiting effect of temperature upon the activities of these insects even during the month of their greatest abundance.

The following table gives the temperature and humidity data [3] for a part of the period under discussion.

[3] Records of relative humidity and temperature were obtained through the courtesy of the U. S. Weather Bureau at Philadelphia, Pennsylvania. All readings are given at 7:30 P.M., Eastern Standard Time.

Dates	Relative Humidity	Temperature	Activity Observed
August 22nd, 1942	74%	80°	Activity
August 23rd, 1942	92%	72°	Activity
August 24th, 1942	57%	64°	No activity
August 25th, 1942	52%	64°	No activity
August 26th, 1942	58%	68°	Activity
August 27th, 1942	59%	68°	Activity
August 28th, 1942	70%	72°	Activity

The dependence of swarming on environmental conditions is further documented by the detailed comparison that appears on the two graphs (figs. 1 and 2). These graphs represent weather bureau data for September 1942 and 1943 together with the

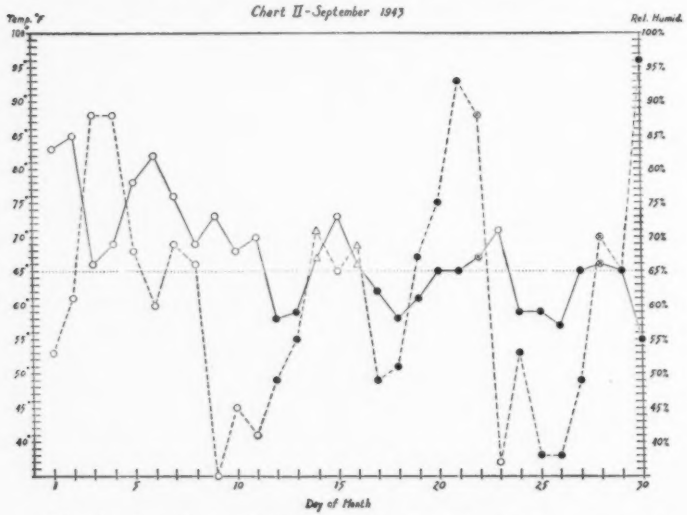

Fig. 2. Records for September 1943. Symbols are the same as in fig. 1.

daily records on flight activity. Temperature and humidity are both represented, by a solid and a broken line respectively, and are plotted against the days of the month. The 65° temperature level is indicated by a dotted line, for at temperatures below this

no activity was ever observed by the writer. Attention is called to those days that show a sudden drop in temperature correlated with absence of activity, for example, on September 12th, 1943, when the temperature registered 58°, 12° lower than on the day before. During the remaining days of the month, except the 15th and 23rd, which were recorded at 73° and 71° F., respectively, the temperature maintained a constant low level, thus causing all flight movements to be discontinued. The humidity difference, however, does not appear to represent a limiting factor as regards the aerial performances of these insects.

Observations on Swarming Maneuvers

The observations for 1943 were made on a series of companies of *Hexagenia atrocaudata* swarming over the stream near the same locality as in the previous year. The performances began well after sundown and lasted until fully covered by darkness.

Copulation was observed in several instances and took place in a manner strikingly similar to that found in other genera of this order.

The following detailed observations on the swarming or mating-flight were made about 7:00 P.M., August 9th, 1943.

The individuals ascended to about fifteen feet above the water and then descended in an almost vertical power dive to about eighteen inches from its surface. At this point they pulled upward again and forward to a horizontal position, from whence they again descended. These movements were repeated over and over until darkness intervened.

As regards the flights occurring over the land, these were, for the most part, far more compact than those conducted over the stream. They were of shorter duration and were executed in a series of vertical zigzag-like movements, describing 45° angles, in rapid succession. At the height of the performance the individuals showed a high nervous tension with only feeble attempts toward copulation. Near the end of activity, the swarm apparently reached such a state of flux and disorder that the failure of individuals to avoid capture was far more noticeable than their attempts to elude the net; a tendency so unlike that

observed in *Isonychia,* which I found very net-shy, or in *Callibaetis,* which Needham [4] records as among the most wary forms.

Discussion

Clemens [5] and Murphy [6] have already recorded that low temperatures inhibit activity. My own observations, as recorded in detail above, also indicate cessation of activity below 65° F. Although the records are for *Hexagenia* the essential facts involved are also manifested in the behavior of *Isonychia.* As regards the possible influence of humidity, no definite conclusions are drawn.

The movements in the mating flight of *Hexagenia* are characteristic and peculiar and readily distinguishable from those of *Stenonema* and *Isonychia.* They appear to differ also from the movements of other genera as described in the literature by Needham and other writers.

Although they had not been found in the preceding years, during the two years of this study, 1942 and 1943, members of *H. atrocaudata* were quite numerous. During August of the following year, 1944, the swarm became so greatly reduced that only small companies could be encountered under the most favorable condition, and, finally, by the summer of 1945, flight movements became completely suspended. The decline and disappearance of this species during certain seasons remains one of the most baffling mysteries of my ephmeridal investigations in this area.

In a recent report on the emergence and flight movement of the species of *Hexagenia,* Lyman [7] observed that wind direction aided in the distribution of sub-imagines and imagines while in flight. He also advanced the theory, supported by Langlois,

[4] Needham, J. G., Jay R. Traver, and Yin-Chi Hau, 1935. The biology of the mayflies. P. 10.

[5] Clemens, W. A., 1917. An ecological study of the mayfly Chirotenetes. University of Toronto Studies Biol. Ser. 17.

[6] Murphy, Helen, 1922. Notes on the biology of the mayflies genus *Baetis.* Bull. Lloyd Library, Ent. Ser. 2.

[7] Lyman, Earl F., 1944. Emergence, swarming and mating in *Hexagenia.* Ent. News, 55: 207–210.

that the difference in emergence for alternating years indicated a cyclic trend in the population of *Hexagenia.*

Because of the very nature of the rocky stream-bed over which my own surveys have been constantly conducted, it seems that only with the greatest difficulty could the immature stage of *Hexagenia atrocaudata* have survived without having been previously encountered.

The writer wishes to acknowledge his gratitude to Dr. Philip P. Calvert, of the University of Pennsylvania and the Academy of Natural Sciences, for his stimulating interest freely shown during the course of this study. Thanks are also due Mr. Howard Levy of City College, New York City, graduate student of Dr. H. Spieth, for confirming the classification of the species here involved.

Odonata of Voyages under the Auspices of the New York Zoological Society

By Philip P. Calvert, Cheyney, Penna.

When sending me Odonata collected at the Tropical Research Station of the New York Zoological Society at Kartabo, British Guiana,[1] Dr. William Beebe, Director of the Station, sent also some Odonata collected on various voyages made under the auspices of the Society. These are listed below with a few comments.

I. Voyages of the Steam Yachts *Noma,* 1923, and *Arcturus,* 1925, to the Galápagos

Indefatigable Island, Seymour Bay, April 22, 1923: *Pantala flavescens* (Fabricius), one male.

South Seymour Island, April 23, 1923: *P. flavescens,* three males.

Hood Island, Lake, 27.IV.1925: *Tramea* (*Trapezostigma*) *cophysa darwini* Kirby, one male.

[1] These are reported on in a paper to be published in Zoologica, the Society's journal.

Albemarle Island, 8/6/25: *T.* (*T.*) *cophysa darwini,* three females.

It is to some of these 1923 specimens that the following observations, recorded in Dr. Beebe's book, Galapagos World's End,[2] doubtless refer.

"Large dragonflies were hawking about, taking toll of the mosquitoes which I frightened out of the grass. I found it almost impossible to capture them in a net. So . . . using a 22 calibre rifle, and shot cartridges, I shot at them." Seven specimens were secured; South Seymour Is., April 23, 1923.

"On other evenings as long as there was light enough for us to see, we never failed to observe a host of dragonflies hawking back and forth, while now and then little yellow-bellied flycatchers [*Myiarchus magnirostris* (Gray), p. 435] would dive into the mass, their beaks snapping like castanets; South Seymour Is., April 26, 1923."

The following specimen resulted from the voyage of the *Noma: Pantala hymenaea* (Say), one female "2535 Panama 60 M[iles] offshore 6/5/23."

The following three specimens bear no dates or other identifying labels but are products of the voyage of the *Noma* or of the *Arcturus:*

"N 4° 30′ W 87°," *P. flavescens,* one male, *P. hymenaea,* one female; "N 4° 30′ W 80°," *P. hymenaea,* one female.

Both reckonings indicate points in the Pacific Ocean to the northeast of the Galápagos, the former roughly 535 km. (335 statute miles, 288 nautical miles) distant, the latter roughly 1100 km. (687 or 594 miles) distant from them.

P. hymenaea and a species of *Tramea* were apparently first recorded from the Galápagos by McLachlan[3] from collections made by Commander W. E. Cookson and Staff Surgeon Bett, of H.M.S. *Petrel,* in June, 1875, on Charles, Abingdon, and Albemarle Islands, but no indication is given as to which of

[2] Galapagos World's End. Published under the auspices of the New York Zoological Society. G. P. Putnam's Sons, New York and London, The Knickerbocker Press, 1924. Pages 285, 291, 292.

[3] Proc. Zool. Soc. London, 1877: 84–86.

these islands furnished the Odonata. McLachlan did not describe the three adult Trameas which he examined, as they were in bad condition, but mentioned that they had "only a very small dark anal spot on the hind wings," a feature which agrees well with *T. darwini* Kirby, but he described nymphs which he referred to *P. hymenaea* and *Tramea*. *Darwini* was described [4] from the "Galápagos Islands" with no mention of the individual islands from which they hailed.

In the fullest account of the Odonata of the Galápagos which we possess, that by Mr. R. P. Currie,[5] based on the collections of Mr. R. E. Snodgrass in 1899, and the U. S. Fish Commission, *P. flavescens* and *P. hymenaea* are recorded from Charles Island, *T. darwini* from Albemarle, South Albemarle, Charles, Chatham and Hood Islands, not to mention other species not represented in the present collection.

II. Cruise of the Tug *Light Horse*, 1928

"100 m[iles] off shore, 25187," *Ischnura ramburi* Selys, one heterochromatic (orange) female. This is a common Atlantic coastal species from Rhode Island to northern South America.

III. New Nonsuch, Bermuda

"New Nonsuch, Bermuda, 9–VI–40 pool" and Bermuda, 1937, *Tramea* (*Trapezostigma*) *abdominalis* (Rambur), one male; *Pachydiplax longipennis* (Burmeister), one male.

Both of these species and five others, according to Verrill,[6] were recorded from the Bermudas by J(ohn) Matthew Jones [7] in 1876, based on identifications by Dr. H. A. Hagen. Later captures of *P. longipennis* are mentioned by Uhler [8] and Verrill.[6]

[4] Trans. Zool. Soc. London, 12 (9, 3): 315, pl. LI, fig. 1. 1889.

[5] Proc. Washington Acad. Sci., 3: 385–386. 1901.

[6] The Bermuda Islands. Trans. Connecticut Acad. Arts & Sci., 11 (2): 812–816, 850. 1901–02.

[7] The Visitor's Guide to Bermuda. Halifax, New York and London, 1876, 12mo., 159 pp. I have not seen it.

[8] In Angelo Heilprin, The Bermuda Islands, Philadelphia, 1889, p. 154.

IV. Bahama Islands

Erythrodiplax umbrata (Linn.), one female, "on Ancon, 2 miles off Castle Rock Light, Dec. 22, '40."

This widespread tropical American species has been recorded [9] from the following Bahaman localities: Strange Cay, New Providence, Andros, Crooked and Great Inagua Islands.

Astata in the Caribbees (Hymenoptera: Sphecidae)

By V. S. L. Pate, Ithaca, New York

Over eighty years ago Cresson described *Astata insularis* from Cuba.[1] In all the intervening years no other member of the genus has been recorded from any of the Antilles. Now, however, another closely related but quite distinct form, *Astata dominica*, is known to inhabit the island of Hispaniola and is described below.

Astata (Astata) dominica new species

The completely red abdomen, the presence of a fine impunctate line bisecting the front, the more finely punctate mesonotum, and the punctate postscutellum differentiate the present Hispaniolan *dominica* from Cresson's Cuban *insularis*. In addition, the dorsal propodeal face of *insularis* is bisected by a carina on each side of which are divergent longitudinal rugulae which radiate from the posterior margin of the postscutellum, whereas in *dominica* this area is furnished with transverse carinulae and lacks any bisecting carina.

Type.—♀; San Domingo. (No other data.[2]) [Academy of Natural Sciences of Philadelphia, Type no. 10606.]

Female. Length 11 mm. Black; abdomen completely bright ferruginous. Wings hyaline, tinged with fuscous, rather heavily infumated apically beyond the cells; veins and stigma dark brunneous.

[9] Biol. Centr.-Amer. Neur., p. 253, 1906; Ann. Carnegie Mus. Pittsburgh, 6 (1): 247–248, 1909.

[1] Proc. Entom. Soc. Philadelphia, IV, p. 140, (1865); [♀].

[2] This specimen was probably collected by M. Abbott Frazar in or about Sanchez in the Samaná district of the Dominican Republic.

Head fulgid; with a rather heavy vestiture of long, erect white hair except on vertex. Front gently tumid, with separated, fine punctures throughout except for a polite, small quadrate area between and above antennal sockets, and a narrow line bisecting front from anterior ocellus to clypeus; ocelli in a subequilateral triangle, the ocellocular line four-ninths (0.44) the postocellar distance; vertex and posterior orbits polite, almost impunctate. Clypeus with fine, well-separated punctures throughout, disc gently tumid; median length one-fourth the vertical eye length; median lobe terminating in a broad, impunctate, polite, truncate flange. Antennae with scapes strongly obterete, coarsely punctate, three-tenths the vertical eye length; pedicel suborcate; flagellum simple, filiform; relative lengths: scape 25; pedicel 8; flagellar segment one 30, two 24, three 22, four 20, five 15, six 18, seven 15, eight 15, nine 13, ten 15. Upper interocular line six-tenths the vertical eye length.

Thorax fulgid; with a moderate clothing of erect white hair which is longer and more noticeable on pleura and venter than on mesonotum. Pronotum situated well below level of arched mesonotum, gently declivent from posterior margin; with fine, separated punctures; anterior half bisected by a fine impression. Mesonotum with fine, rather close punctures anteriorly but disc and posterior two-thirds almost impunctate; parapsidal furrows distinct on posterior two-thirds; scutellum finely, closely punctate laterally and along posterior margin, the disc polite, impunctate; postscutellum finely punctate throughout. Mesopleura with strong, rather close punctures which become striatopunctate dorsally and posteriorly; metapleura glabrous, polite, impunctate. Propodeum fulgid; dorsal face glabrous, posterior and lateral faces with a moderate vestiture of very long, erect, white hair; dorsal face impunctate, traversed by fine, sharp, well-separated carinulae which are arcuate anteriorly but become transverse posteriorly; posterior face coarsely punctate save for polite, immarginate, pyriform discal fovea, laterally with coarse horizontal carinulae which pass around onto posterior half of lateral faces, the anterior half of which are polite and subimpunctate.

Legs stout; tibiae and tarsi spinose.

Fore wing with marginal cell three and a quarter times as long as wide and broadly, squarely truncate at apex; radius with relative lengths of abscissae: first 5, second 6, third 25, fourth 20, fifth (truncation) 12; cubital abscissae: first 36, second 48, third 25. First submarginal cell about nine-tenths (0.924) the length of marginal cell.

Abdomen cordate, depressed; fulgid; impunctate; subglabrous. Last tergite with an elongate trigonal pygidial area, the disc finely shagreened, the lateral margins fringed with brushes of stiff dark setulae.

This insular form is known only from the unique female described above.

Megarhinus septentrionalis from Pennsylvania

By Robert M. Stabler, Colorado College, Colorado Springs

In their excellent listing of the mosquitoes of Pennsylvania Wilson, Barnes, and Fellton (1946) do not mention the occurrence of a *Megarhinus*. Matheson (1944), in his Handbook of the Mosquitoes of North America, lists the two species *M. septentrionalis* and *M. rutilus*. Of the former he says, "It occurs in the eastern United States, from Virginia south to the Gulf. . . ." The latter is from Florida. Headlee (1945) states of *M. septentrionalis*, "Southeastern United States. No females have been trapped from 1932 to 1941 inclusive" [New Jersey]. It is the purpose of this note to record the first taking of *Megarhinus septentrionalis* from Pennsylvania.

On September 20, 1946, Dr. R. G. Schmieder noticed a large, long-legged insect flying about his living room in Elwyn, Delaware County, Penna. It lit on the wall, was captured, and finally came to the attention of the writer. It proved to be a perfect specimen of *Megarhinus septentrionalis*. As neither of the two species of *Megarhinus* thus far found in the United States has been reported from Pennsylvania, determining the ultimate source of this specimen (female) is something of a

problem. Was she actuallv hatched in Delaware County? Did she "hitch-hike" up from the south in an automobile? The closest point at which she might have gotten off a train from the south is Chester, Penna., some five miles from the point of capture.

The fact that the Delaware County Mosquito Extermination Commission, which has reliable records going back more than ten years, lists no single individual of this species only serves to heighten the mystery of her sudden and unique appearance in a state completely foreign to her genus. But these are the delightful biological exceptions which make the routine more bearable.

The writer is most grateful to Dr. Schmieder for allowing him to present this new record. The specimen is in the writer's collection.

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WILSON, C. A., R. C. BARNES, and H. L. FELLTON. 1946. A list of the mosquitoes of Pennsylvania with notes on their distribution and abundance. Mosquito News, 6 (2): 78–84.

A New Species of Stenocrates from Central America

By MARK ROBINSON, Springfield, Pennsylvania

Stenocrates bicarinatus new species

1890. *Stenocrates laborator* Bates not Fabr., Biologia Centrali-Americana, Vol. II, part 2, p. 313.

This is probably the species mentioned by Bates as *Stenocrates laborator* Fabr. from Tuxtla, Mexico. It differs from the older species as mentioned by Bates by the margin of the frontal suture being somewhat raised on each side and in the fewer punctures of the thorax. In addition to the differences in the external

characters the extreme tip of the male genitalic claspers of *laborator* are bilobed while the new species has these claspers unilobed.

The male of *bicarinatus* has the club of the antennae a little longer and the pygidium a little more convex than the female.

Body elongate, subcylindric; color black the underparts dark reddish.

Edge of clypeus reflexed, the anterior edge a little more than the sides; anterior edge sinuate with the angles on either side broadly rounded. The posterior edge of the clypeus is raised on either side of a median area into a carina which runs to the side margins. The surface of the frons and clypeus is smooth with a few fine punctures except for the part behind the clypeal edges, the clypeal suture and the median area between the carinae which are coarsely rugous.

The side margins of the pronotum are margined. The pronotal area is finely, very sparsely punctured with a few coarse punctures near the hind angles.

Scutellum impunctate. Elytral punctures shallow, coarse, annular, arranged on either side of four costae and in the intercostal areas; costae impunctate.

Pygidium coarsely, annularly punctured, with these punctures separated from one to three times their diameters. Anterior tibiae tridentate. Post-coxal process of the prosternum long, gradually acuminate, with a few yellowish hairs about the tip.

Length, 18.5 to 20.0 mm.; breadth, 9.5 to 10.3 mm.

Type.—♂; Corozal, CANAL ZONE, May 31, 1937 (R. Bliss). In the collection of the author.

Allotype.—♀; Piedras Negras, GUATEMALA, June 30, 1933 (D. W. Amram). In the collection of the Academy of Natural Sciences, Philadelphia.

Paratype.—♂; Yariza, PANAMA, May 25, 1933 (D. Elmo Hardy). In the collection of the author.

Notes and News in Entomology

Under this heading we present, from time to time, notes, news, and comments. Contributions from readers are earnestly solicited and will be acknowledged when use.

Recollections about Samuel Francis Aaron. After reading Dr. Philip P. Calvert's account in ENTOMOLOGICAL NEWS (June, 1947), of S. Frank Aaron who died on January 15, 1947, it occurred to me that the following recollections might be of supplementary interest. I became acquainted with Mr. Aaron during the summers of 1904 and 1906, while employed by the Philadelphia Commercial Museum. As Dr. Calvert has stated, Mr. Aaron was the economic entomologist of the Museum. At this period he was concerned with the preparation of exhibits of various economic insect pests. He did much of this work himself and many of the exhibits were illustrated by his drawings which showed considerable artistic skill. During 1906 Mr. Aaron, together with a Mr. Hamilton, organized the Scientific Preservation Company and obtained the financial backing of several wealthy Philadelphians. This company, located in an imposing building at 305–307 Walnut Street, Philadelphia, was prepared to exterminate mosquitoes, San José scale, household pests, etc., and did considerable advertising to this effect. It also provided moth-proof storage and manufactured a "moth proof" storage chest for household use. This was a well-made, tight, cedar chest furnished with a small inside compartment containing two charges of sulphuric acid and potassium cyanide. These chemicals were brought together, by an operation outside the chest by the owner, which liberated hydrocyanic acid gas in the chest. After an interval long enough for eggs to hatch, the second charge was set off.

Most of the customers of the company were hotels and warehouses in the Philadelphia area and wealthy estate owners in the suburbs of the cities of Philadelphia and Camden. At that time the San José scale was doing much damage to fruit trees and the company used a mixture of hydrocyanic acid gas and a small amount of chlorine in its fumigation work. Large fumigation tents were erected over the trees by means of long poles of several sections. It is my belief that the Scientific Preserva-

tion Company was the first large scale effort to commercialize entomology in the east. The fumigation of orchard trees by commercial firms was going on in California at that time but the Scientific Preservation Company was the first eastern firm in the field.

I was taken into the company by Mr. Aaron, shortly after its organization, as a sort of assistant chemist and biologist and, at one time, was very nearly killed by breathing, over a period of several hours, minute quantities of hydrocyanic acid gas in the laboratory atmosphere. The men employed to do the fumigation work were warned to open the windows of fumigated buildings from the outside, but frequently they were careless or too lazy to affix cords to upper sashes and preferred to take a chance by holding their breaths while entering a room and opening windows. No fatalities occurred but the workers always returned with blood-shot eyes after engaging in this practice.

Mr. Aaron was manager of the company, which was organized during the latter part of 1906. It remained in operation only until the end of 1907. The idea behind it was good and a modest amount of business was done during its existence. Unfortunately its first year of operation coincided with the business panic of 1907 which lasted until the middle of 1908. Its financial backers refused to invest additional funds to keep it going and so it came to an end in December, 1907. At this time the business was leased by Harry B. Weiss and Thomas W. Shaw, both former employees who hoped to keep it going, with a reduced overhead. However, they were starved out after four or five months. I still have the agreement, signed by Mr. Aaron in a spirit of fun and generosity on December 3, 1907, in which he promised to give each of the lessees ten thousand dollars worth of stock in case the business of the Scientific Preservation Company increased so as to enable dividends to be paid.

After this venture, Mr. Aaron, for a short time, managed a private hunting lodge in Delaware and then devoted himself to writing popular entomological articles and nature papers for magazines and newspapers. I recall him as a very well informed, affable, enthusiastic and entertaining companion, who got much enjoyment out of natural history.—H. B. Weiss.

How far can a fly fly?—In reply to a question that came to the American Entomological Society, Dr. Calvert answered as follows:

I am not able to answer fully your subscriber's question: "What distance is a fly able to fly before it is forced to stop for rest?" The best I can do follows.

H. M. Bernard, investigating the effects of fatigue upon the microscopic structure of fly's muscle wrote: "I caught a number of large Blue-bottles—*Musca vomitoria.* Some were kept resting under glass, the others, one at a time, I compelled to fly about a nearly empty room. In a few minutes they dropped down exhausted, so that no pushing or handling could induce them to fly." (Zoologische Jahrbücher, Abt. f. Anat. 7: 540–41. 1894.) Unfortunately, he does not specify the actual number of minutes before the flies "dropped down exhausted."

A. Magnan, in his elaborate study of the flight of insects, measured the speed of their flight by two different methods and gives a table including the maximum speed of flight in the blue-bottle fly, *Calliphora vomitoria,* as three meters per second, of the house fly, *Musca domestica,* as two meters per second. (La Locomotion chez les Animaux I. Le Vol des Insectes. Paris, Hermann & Cie. 1934. P. 71.)

Calliphora vomitoria is the same species to which Bernard refers as *Musca vomitoria.*

If we combine the results of these two authors, we find that the blue-bottle fly can fly 3 m. × 60 = 180 meters per minute. We may suppose that Bernard's "few" minutes were probably as many as five so that his flies could go 900 meters in that time. If a "few minutes" were as many as ten, then 1800 meters might be the extent of their flight. 900 meters = .56 mile, 1800 meters = 1.12 miles.—PHILIP P. CALVERT.

Dr. Calvert expresses the hope that some reader can supply fuller data on this question.—EDITOR.

Current Entomological Literature

COMPILED BY EDWIN T. MOUL AND
RAYMOND Q. BLISS.

Under the above head it is intended to note papers received at the Academy of Natural Sciences of Philadelphia and the University of Pennsylvania, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

This list gives references of the current or preceding year unless otherwise noted. Continued papers, with few exceptions, are recorded only at their first installment.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

NOTE: The figures within brackets [ ] refer to the journal in which the paper appeared, as numbered in the List of periodicals and serials published in our January and June issues. The number of the volume, and in some cases, the part, heft, &c. is followed by a colon (:). References to papers containing new forms or names not so stated in titles are followed by (*); if containing keys are followed by (k); papers pertaining exclusively to Neotropical species, and not so indicated in the title, have the symbol (S).

Papers published in ENTOMOLOGICAL NEWS are not listed.

GENERAL—Anduze, Pifano and Vogelsang—Nomina de los artropodos vulnerantes conocidos actualmente en Venezuela. [14] 6: 1–16. **Anon.**—DDT for control of household pests. [Bur. Entom. and Plant Quarantine] March, 1947. **Bateman, A. J.**—Contamination of seed crops. Insect pollination. [Jour. Genetics] 48: 257–75. **Essig, E. O.**—Abstracting entomological articles and publications. [37] 40: 456–58. **Faure, J. C.**—A plea for brevity and sanity in zoological nomenclature. [6] 13: 595–601. **Callan, E. McC.**—Technique for rearing thrips in the laboratory. [53] 160: 432. **Leonard, M. D.**—The "Special survey in the vicinity of ports of entry" as a contribution to "A list of the insects of New York." [45] 55: 215–17. **McAtee, W. L.**—Popular names of Gyrinidae. [45] 55: 205–06. **Osborn, H.**—On the status of grass insects. [65] 49: 149–50. **Reed, Bunn and Blanton**—Entomology in the army. [37] 40: 289–93. **Smith, H. S.**—Biological control of weeds in the U. S. [65] 49: 169–70.

ANATOMY, PHYSIOLOGY, MEDICAL—Balfour-Browne, J.—On the false-chelate leg of an aquatic beetle larva. [68] 22: 38–41, ill. **Callan and Montalenti**—Chiasma interference in mosquitoes. [Jour. Genetics] 48: 119–34. **Calvert, P. P.**—How many mosquito larvae and pupae are required to make one dragonfly? [65] 49: 171–72. **Gjullin, C. M.**—Effect of clothing color on the rate of attack of Aëdes mosquitoes. [37] 40: 326–27. **Goldschmidt, E.**—Studies on the synapsis in salivary chromosomes of

hybrid Chironomus larvae. [Jour. Genetics] 48: 194–205. **Gounin, F.**—Le cardia de l'intestin larvaire de quelques chironomides, son importance pour la systématique (Nematocères). [Rev. Franç. d'Ent.] 13: 28–33, ill. **Grasse and Hollande**—Structure de l'appareil copulateur mâle des acridiens et ses principaux types. [Rev. Franç. d'Ent.] 137–46, ill. **Hinton, H. E.**—The gills of some aquatic beetle pupae (Psephenidae). [68] 22: 52–60, ill. **Horen, W. P.**—Effects of ultra-violet radiation on Tenebrio molitor. [37] 40: 433–34. **Jeannel and Paulian**—Morphologie abdominale des Coleoptères et systématique de l'ordre. [Rev. Franç. d'Ent.] 11: 65–110, ill. **Mickey, G. H.**—Division cycle in grasshopper chromosomes. [Proc. Louisiana Acad. Sci.] 10: 49–66, ill. **Lamy, R.**—Observed spontaneous mutation rates in relation to experimental technique. [Jour. Genetics] 48: 223–36. **Linsley and MacSwain**—The effects of DDT and certain other insecticides on alfalfa pollinators. [37] 40: 358–63; Factors influencing the effectiveness of insect pollinators of alfalfa in California. *Ibid.* 349–57. **Mackensen, O.**—Effect of carbon dioxide on initial oviposition of artificially inseminated and virgin queen bees. [37] 40: 344–49. **Millot, J.**—Sur l'anatomie et l'histophysiologie de Koenenia mirabilis Grassi (Palpigradi). [Rev. Franç. d'Ent.] 9: 33–51, ill.; Notes complémentaires sur l'anatomie, l'histologie et la repartition géographique en France de Koenenia mirabilis Grassi. *Ibid.* 127–35, ill. **Muller, J.**—Investigacion de una cera producida por un insecto coccido Venezolano. [Bol. Soc. Ven. Cien. Nat.] 10: 365–81. **Pfadt, R. E.**—Effects of temperature and humidity on larval and pupal stages of the common cattle grub. [37] 40: 293–300. **Pierre, F.**—La larve d'Heterocerus aragonicus Kiesw. et son milieu biologique. [Rev. Franç. d'Ent.] 12: 166–74, ill. **Risbec, J.**—Sur le determinisme de la metamorphose chez les Lepidopteres. A propos d'une chenille ayant evolue dans un nid d'Eumenes. [Rev. Franç. d'Ent.] 13: 144–50, ill. **Roberts, W. C.**—A syringe for artificial insemination of honey bees. [37] 40: 445–46. **Snodgrass, R. E.**—The insect cranium and the "epicranial suture." [Smithsonian Misc. Coll.] 107, no. 7: 1–52. **Swann and Mickey**—Parthenogenetic grasshoppers and their bearing upon polyploidy and sex-determination. [Proc. Louisiana Acad. Sci.] 10: 73–92, ill. **Tate, P.**—A sex-linked and sex-limited white-eyed mutation of the blowfly (Calliphora erythrocephala). [53] 160: 361; [Jour. Genetics] 48: 176–91; The effect of cold upon the develop-

ment of pigment in a white-eyed mutant form of the blowfly C. erythrocephala. [Jour. Genetics] 48: 192–93. **Vogt, G. B.**—Salinity tolerance of Anopheles quadrimaculatus and habitat preference of A. crucians bradleyi. [37] 40: 320–25. **Wigglesworth, V. B.**—Water relations of insects. [Experientia] 2: 1–14, ill. **Williams, J. L.**—The anatomy of the internal genitalia of Fumea casta Pallas. [83] 73: 77–84, ill. **Wolfenbarger, D. O.**—Tests of some newer insecticides for control of subtropical fruit and truck crop pests. [31] 29: 37–44.

ARACHNIDA AND MYRIOPODA—Killington and Bathe—Acarine parasites of Odonata. II. [28] 83: 116–24. **Millot, J.**—(See under Anatomy.) **Paulian de Felice, L.**—Les Oniscoides de la Guyane Française. [Rev. Franç. d'Ent.] 10: 142–45, ill. (S*). **Saunders, L. G.**—Canadian solpugids. [Canad. Field Nat.] 60: 132.

SMALLER ORDERS—Anderson, A.—Dragon flies feed on termites. [Great Basin Nat.] 7: 29. **Broadhead, E.**—The life-history of Embidopsocus enderleini (Corrodentia). [28] 83: 200–03. **Brues, C. T.**—Predatory enemies of winged termites. [65] 49: 167–68. **Callan, E. McC.**—Technique for rearing thrips in the laboratory. [53] 160: 432. **Calvert, P. P.**—The odonate collections of the California Academy of Sciences from Baja California and Tepic, Mexico, of 1889–1894. [64] 23: 603–09. (See also under Anatomy.) **Hopkins, G. H. E.**—Lice. [Uganda Journal] 10: 97–105. **Killington and Bathe**—(Odonata, see under Arachnida.) **Mullen, J. A.**—Termites in cold frames. [100] 25: 164.

ORTHOPTERA—Grasse and Hollande.—(See under Anatomy.) **Mickey, G. H.**—(See under Anatomy.) **Rehn, J. A. G.**—The removal of the mantid genus Callimantis (Manteidae) from the North American fauna. [65] 49: 163–64. **Rosewall, O. W.**—Biology of the praying mantis, Brunneria borealis Scudder. [Proc. Louisiana Acad. Sci.] 10: 67–71, ill. **Swann and Mickey**—(See under Anatomy.)

HEMIPTERA—Fennah, R. G.—Notes on West Indian Flatidae (Fulgoroidea). [63] 60: 107–18, ill. (*). **Knowlton, G. F.**—Aphids from Mt. Timpanogos, Utah. [Great Basin Nat.] 7: 1–6. **McKenzie, H. L.**—Diaspid scale studies, with notes on California species (Coccoidea: Diaspididae). [Bull. Dept. Agric. State of Cal.] 36: 31–36, ill. (*). **Muller, J.**—(See under Anatomy.) **Tanner, V. M.**—Ranatra quadridentata found in Utah. [Great Basin Nat.]

7: 29. **Wygodzinsky, P.**—Sobre um novo genero e uma nova especie de schizopterinae do Brasil (Cryptostemmatidae). [14] 6: 25–35, ill. (k).

LEPIDOPTERA—Bell, E. L.—A catalogue of the Hesperioidea of Venezuela. [14] 5: 65–203. **Bourquin, F.**—Metamorfosis de Tolype pauperata. [Rev. Soc. Ent. Argentina] 13: 301–08, ill. **Clark, A. H.**—The interrelationships of the several groups within the butterfly superfamily Nymphaloidea. [65] 49: 148–49. **Darlington, E. P.**—Notes on certain types of Lepidoptera described by Brackenridge Clemens. [83] 73: 85–104. **Dexter, R. W.**—A checker-spot butterfly with three antennae. [100] 25: 145, ill. **Evans, W. H.**—Hesperiana. [65] 49: 162–63. **Judd, W. W.**—Leaf-rollers of the genus Cacoecia (Tortricidae). [Canad. Field-Naturalist] 60: 136. **Needham, J. G.**—A moth larva that lives on fern spores (Heliodinidae). [65] 49: 165–66. **Neiswander, C. R.**—Variations in the seasonal history of the European corn borer in Ohio. [37] 40: 407–12. **Risbec, J.**—(See under Anatomy.) **Shaw, J. G.**—Parasites of a bag-making pierid Eucheira socialis in Morelos, Mex. [37] 40: 436–37. **Warren, B. C. S.**—Some principles of classification in Lepidoptera, with special reference to the butterflies. [30] 80: 208–17. **Williams, J. L.**—(See under Anatomy.)

DIPTERA—Abonnenc and Floch—Clef d'identification de 140 Phlebotomes mâles du nouveau continent. [14] 6: 1–24 (k). **Arnett, R. H., Jr.**—Notes on the distribution, habits and habitats of some Panama mosquitoes. [45] 55: 185–200. **Blanchard, E. E.**—Dasyuromyia lloydi nueva especie de Prosenido, Argentino. [Rev. Soc. Ent. Argentina] 13: 258–62, ill. **Bromley, S. W.**—Diptera of Connecticut. Part VI. Asilidae. [State of Conn., Geol. and Natural History Survey, Hartford] Bull. 69, 1–48, ill. (k). **Callan and Montalenti**—(See under Anatomy.) **Calvert, P. P.**—(See under Anatomy.) **Gjullin, C. M.**—(See under Anatomy.) **Goldschmidt, E.**—(See under Anatomy.) **Gouin, F.**—(See under Anatomy.) **James, M. T.**—A review of the Larvaevorid flies of the tribe Leskiini with the setulose first vein (R.). [71] 97: 91–115, ill. (k*). **Kessel, E. L.**—American smoke flies (Microsania: Clythiidae). [The Wasmann Collector] 7: 23–30. **Knight, K. L.**—The Aedes (Mucidus) mosquitoes of the Pacific (Culicidae). [48] 37: 315–25, ill. (k*). **Lamy, R.**—(See under Anatomy.) **Pfadt, R. E.**—(See under Anatomy.) **Pletsch, D.**

J.—Anopheles mosquito records and observations in Montana. [Great Basin Nat.] 7: 23–28. **Rapp, W. F., Jr.**—The Pipunculidae of Quebec. [Canadian Field-Naturalist] 60: 105. **Shaw, J. G.**—(See under Lepidoptera.) **Tate, P.**—(See under Anatomy.) **Vogt, G. B.**—(See under Anatomy.) **Walton, W. R.**—Local unique Tabanid unrecovered after 28 years. [65] 49: 168.

COLEOPTERA—Alonso, R. G.—Escarabajos comunes a chile y la Argentina. [Rev. de la Soc. Ent. Argentina] 13: 309–14. **Balfour-Browne, J.**—(See under Anatomy.) **Barber, H. S.**—Diabrotica and two new genera (Chrysomelidae). [65] 49: 151–61, ill. **Barr, W. F.**—A new subspecies of Enoclerus from the Great Basin region of the western U. S. (Clerid). [Great Basin Nat.] 7: 21–22. **Blake, D. N.**—New eumolpid beetles from West Indies. [48] 37: 310–15, ill. **Bosq, J. M.**—Interesantes longicornios de Catamarca. [Rev. de la Soc. Ent. Argentina] 13: 292–300, ill. **Buck, J. B.**—Studies on the firefly, IV: Ten new lampyrids from Jamaica. [71] 97: 59–79, ill. **Davis, A. C.**—Review of the weevils of the tribe Ophryastini of America north of Mexico. [71] 3207: 96: 483–551, ill. (k*). **Dawson, R. W.**—New spp. of Serica (Scarab) VIII. [45] 55: 223–35, ill. **Gilmour, E. F.**—Further new Lamiinae (Cerambycidae). [28] 83: 187–90, ill. (S). **Green, J. W.**—New eastern American species of Podabrus (Cantharidae). [83] 73: 63–76, ill. **Guignot, F.**—Genotypes des Dytiscoidea et des Gyrinoidea. [Rev. Franç. d'Ent.] 13: 112–18. **Hinton, H. E.**—(See under Anatomy.) **Hustache, A.**—Naupactini de l'Argentine et des regions Limitrophes. [Rev. de la Soc. Ent. Argentina] 13: 3–146 (k*). **Jeannel and Paulian**—(See under Anatomy.) **La Rivers, I.**—Notes on the Histeridae known to occur in Nevada. [Great Basin Nat.] 7: 7–9. **Lepesme and Paulian**—Les nemosoma et genres voisins (Ostomatidae). [Rev. Franç. d'Ent.] 10: 136–41, ill. (S). **Lepesme, P.**—Un remarquable Cerambycide nouveau de Guyane. [Rev. Franç. d'Ent.] 9: 135–37, ill. **McAtee, W. L.**—(See under General.) **Martinez, A.**—Insectos nuevos o poco conocidos V. [Revista Soc. Ent. Argentina] 13: 263–80, ill. **Mequignon, A.**—Contribution a l'étude des mordellides palearctiques. [Rev. Franç. d'Ent.] 13: 52–76, ill. (k*). **Monros, F.**—Revision de los megalopidae Argentinos. [Rev. Soc. Ent. Argentina] 13: 150–217, ill. (*). **Pierre, F.**—(See under Anatomy.) **Plank, H. K.**—DDT for powder-post beetle control in bam-

boo. [80] 106: 317. **Portevin, G.**—Description de Liodides nouveaux. [Rev. Franç. d'Ent.] 9: 75–78, ill. (S). **Prosen, A. F.**—Nuevos cerambicidos Argentinos. [Rev. Soc. Ent. Argentina] 13: 254–57, ill.; Cerambycoidea de Santiago del Estero. *Ibid.* 315–34. **Robert, Frère A.**—Un dermestidé nouveau pour la Province de Québec (Thylodrias contractus). [Le Nat. Canad.] 74: 189–94. **Vosz, E.**—Nachtraeglich bekannt gewordene exotische Attelabinen und Apoderinen (Curculionidae). [Rev. Franç. d'Ent.] 10: 29–34, ill. (S*).

HYMENOPTERA—Cushman, R. A.—A generic revision of the ichneumon-flies of the tribe Ophionini. [71] 96: 417–82, ill. (k*). **Dreisbach, R. R.**—A new sp. of the genus Therion (Ichneumon) with a key to the species of the northeastern states. [45] 55: 201–03. **Enzmann, J.**—Ants associated with apiaries in the New England States. [45] 55: 219–22. **Farrar, C. L.**—(See under Anatomy.) **Farrar, C. L.**—Nosema losses in package bees as related to queen supersedure and honey yields. [37] 40: 333–38. **Fletcher, H. B.**—Magnetic ants. [54] 40: 415, ill. **Haviland, E. E.**—Biology and control of the Allegheny mound ant. [37] 40: 413–19. **Krombein, K. V.**—An unnoticed subgeneric name in Bombus. [65] 49: 170. **Linsley and MacSwain**—(See under Anatomy.) **Mackensen, O.**—(See under Anatomy.) **Moure, J.**—Notas sobre algunas abejas de la Provincia de Salta. [Rev. Soc. Ent. Argentina] 13: 218–53, ill. (*). **Roberts, W. C.**—(See under Anatomy.) **Santis, Luis de**—Dos nuevos Calcidoideos interesantes (Chalcidoidea). [Rev. Soc. Ent. Argentina] 13: 281–91, ill. **Shaw, J. G.**—(See under Lepidoptera.)

Institutum Entomologicum Choui

In order that the work of scientific research may not be affected by the school-lords or political influences, **Prof. Dr. Chou Io,** a famous Chinese entomologist, has contributed all he has saved and scrimped during the eight years of the War of Resistance and all his specimens collected from many a dangerous expedition to the far and remote hinterland of China to establish the Institutum Entomologicum Choui. But, owing to the limitation of means, only a small-scale printing office has

been set up on the basis of a scanty equipment for the publication of the two magazines: **Entomologia et Ars** and **Insecta Sinensium.** A volume has now been rounded off. The institute is now busying itself with the collection of reference literature. Any donations of publications or materials for exchange from entomologists, entomological societies, research institutes or schools will be cordially welcome.—LU JINSHENG, *Address:* Chang-Chia-Kang, Shensi, China.

Reviews

PULGAS. BIBLIOGRAFIA, CATÁLOGO E ANIMAIS POR ELAS SUGADOS. By A. da Costa Lima and C. R. Hathaway. Monografias do Instituto Oswaldo Cruz, No. 4; December, 1946; pp. 1–522; octavo, paper covers (not illustrated). Imprensa Nacional, Rio de Janeiro, Brasil.

This publication is a catalogue of the fleas of the world. It concerns the species described through 1943, and it includes a few American species published during 1944. The first section of the book is devoted to bibliography. The references are arranged chronologically, and within each year, the titles are arranged alphabetically according to authors. This plan is logical from the taxonomist's standpoint, and if one wishes to locate references according to authors, he will find the authors' names listed in the general index, which is very complete and is a guide to the use of the catalogue.

The major portion of the book is the catalogue of species. The ordinal name Suctoria Degeer 1778 is adopted, and the reasons for this are given. It is pointed out that Oudemans' (1908, 1909) division into suborders Integricipita and Fracticipita is no longer tenable. The fleas of the world are arranged principally according to the generic and higher categories employed by Wagner (1939), incorporating the classification of Ewing and Fox (1943) for North American species. The ten families are: Pulicidae, Hectopsyllidae, Malacopsyllidae, Coptopsyllidae, Vermipsyllidae, Lycopsyllidae, Ischnopsyllidae, Stephanocircidae, Hystrichopsyllidae and Dolichopsyllidae. The grouping of fleas into families, subfamilies and tribes is admittedly a highly controversial problem, and the authors have wisely avoided a long discussion or an attempt to propose a

new classification. In the general index to species, or synopsis, preceding the actual catalogue, there are listed 177 genera, 21 subgenera, and 1,193 species and subspecies. This may give the reader some idea of the magnitude of the task of compiling such a catalogue.

For each species the authors give the complete synonymy and references, and also the recorded hosts and distribution. They do not indicate the type host and type locality for each species, and this information, while not necessarily of biological significance, would have enhanced the usefulness of the work for the taxonomist. With regard to the chigoe flea, the authors adopt the generic name *Tunga* Jarocki 1838, following Rothschild (1921) and subsequent authors. They do not cite *Dermatophilus* Guérin-Méneville 1838, a citation which has apparently been overlooked by many authors, including Rothschild. Bequaert (1926) has pointed out that it would be very difficult to decide which of the two generic names was published first, and the reviewer believes that this matter should have received consideration in the catalogue.

The authors have accepted Ewing and Fox's use of *Trichopsylla* Kolenati 1863. This usage includes many North American species, involving a lumping of certain of Jordan's genera and the reduction of *Pleochaetis* Jordan 1933 to subgeneric standing. Since Ewing and Fox were in all probability ill advised in their ideas on this matter, it is unfortunate that the authors have followed them.

Certain emendations have been made, for example: *Dellopsylla* (sic) for *Delopsylla* Jordan 1926, and *Justapulex* (sic) for *Juxtapulex* Wagner 1933. The reasons for these emendations should be given in each case, although it is possible that the former is a lapsus.

On page 147, we find *Parapsyllus huincae* Del Ponte and Riesel 1939 listed as a valid species. In the reviewer's opinion it is a *nomen nudum,* for in their original publication Del Ponte and Riesel merely listed the species with host and locality, stating that it would be described subsequently. This applies also to *Polygenis litargus puelche* (Del Ponte and Riesel 1939, as *Rhopalopsyllus*), although in this case (page 144) the authors state that this species has not yet been described.

The third portion of the book is a list of avian and mammalian hosts, with the species of fleas recorded for each. In the introduction, the authors give the references consulted with regard to host names. The reviewer is well aware of the difficulties of trying to ascertain correct or nearly correct host

names from the literature. Doubtless a mammalogist or ornithologist would have numerous comments on the classification and nomenclature adopted. Being neither of these, the reviewer is not competent to criticize the host list. It is an extremely worthwhile contribution in itself, and it serves its purpose adequately.

The few critical remarks of a specific nature should be construed as constructive criticism, as they are not meant to be derogatory. Of particular interest to medical entomologists will be the wealth of information on recorded hosts and distribution. The book is not intended as a textbook on fleas, and it may not appeal to the worker who lacks training and experience in taxonomy. It is of unusually high calibre and its excellence will be recognized by those who consult and use it. The publication is a useful, valuable, and timely contribution, which is highly recommended for use by trained entomologists. —HENRY S. FULLER, M.D., Assistant Professor of Preventive Medicine, Bowman Gray School of Medicine, Winston-Salem, North Carolina.

FLEAS OF WESTERN NORTH AMERICA; Their Relation to the Public Health. By Clarence Andresen Hubbard. The Iowa State College Press, Ames, Iowa. 1947. ix + 533 pp. Price $6.00.

This is the companion book to Dr. Irving Fox's, "Fleas of Eastern United States," which appeared in 1940, also published by the Iowa State College Press.

Hubbard gives, besides the systematic classification, some history of the study of the western fleas with portraits of the students of Western American Fleas and their contributions.

The medical importance of fleas is stressed as regards the bubonic plague, typhus fever and tularemia. The author gives warning, particularly, of the presence of the causative organism of bubonic plague in the wild rodents of the Pacific and Rocky Mountain regions; another chapter is given to field and laboratory technique. His illustrations accompanying most of the descriptions of more than 230 species and subspecies are original and clearly give the features he considers of importance.

Under each species, besides the more important bibliographical references, is given a brief description of what is known of the range of the species, preferred hosts, seasonal distribution, biology, and records of material examined.

Part III contains pp. 391–533, includes the host index: of western rodent fleas, fleas of western carnivora, of western insectivora, of western bats and birds, and fleas reported from man; also a selected bibliography and a complete index.

This should be an indispensable book to the students of Siphonaptera.—E. T. CRESSON, JR.

CHEMICAL INSECT ATTRACTANTS AND REPELLENTS. By Vincent G. Dethier. Blakiston Company, Philadelphia, 1947. Pp. xv + 289, 69 figures. Price, $5.00.

The coming into common use of the new and easier word "attractant" (the 1915 Webster gives only "attrahent") is indicative of the rapidly developed interest in the study of substances that attract insects. In recent years, a great many empirical investigations on the attrahent and repellent qualities of innumerable chemical compounds have been carried out; but there has also been much thoughtful research on the fundamental problems involved in the specific reactions of insects to the chemical stimuli of their environment. The facts and ideas that are contained in the voluminous literature have now been, in this book, for the first time, sifted out, critically examined, and presented in a carefully organized form.

The book can be used for practical, economic, purposes, for it names the substances and gives formulae and references to the literature. But of far greater interest and value is the thorough understanding it imparts of the basic principles involved in the studies on attractants, the descriptions of methods of investigation that it outlines, and the attention it gives to the difficulties and complexities inherent in any work on olfactory responses.

Attractants are classified as related to food, to oviposition and to sex. The various kinds are then taken up in turn, with a study of their source, chemistry and effect on the insect. Baits and traps are considered and, finally, the chemical basis of taste and olfaction, and the search for some relation between attrahency and repellency to molecular configuration or to physical properties come up for discussion. The last chapter deals with the mechanism of choice, its physiological and genetic basis, and the evolutionary relationship between polyphagy and oligophagy.

The documental tables, graphs and illustrations, the literature references following each chapter, and the full index are excellent features of the book.—R. G. SCHMIEDER.

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale or services rendered. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and, only when necessary those at the top (being longest in) are discontinued.

Chrysididae—Wanted for determination in preparation of revision. Wm. G. Bodenstein, Galesville, Maryland.

Wanted—Ataenius and allied Aphodiinae from all parts of the world, especially Mexico, Central and South America. O. L. Cartwright, Clemson, S. C.

Wanted—Reprints and unpublished mss. on biological control of mosquitoes; for preparing annotated bibliographies for publication. J. B. Gerberich, Michigan State College, East Lansing, Mich.

Wanted—Hesperid genus Megathymus for exchange or purchase. P. S. Remington, 5570 Etzel Ave., St. Louis 12, Missouri.

Wanted—Psychodidae of North America for revisional purposes. Wm. F. Rapp, Jr., 203 Harker Hall, Urbana, Ill.

Diptera—Tachinidae-Dexiidae wanted, No. Amer. and exotic. Will collect most orders in exchange or will purchase. P. H. Arnaud, 60 Woodrow St., Redwood City, Calif.

Will collect—Zoological and entomological specimens in tropical and subtropical parts of Peru. Jose M. Schunke, Pucallpa, Peru.

Wanted—Diplotaxis; will buy or exchange. E. W. Mange, 307 W. Walnut St., Hanover, Pa.

Hymenoptera-Aculeata (except ants and bees) for exchange. Will collect other orders in exchange. N. F. de Andrade, Casal Novo, S. João do Estoril, Portugal.

Meliponidae—Wanted, information on the bionomics, culture, and economic importance of the stingless bees, particularly of the Old World. P. Nogueira Neto, Av Cicade Jardim 170, S. Paulo, Brasil.

Wasps (Vespoidea, Sphecoidea, Chrysidoidea) of the world by exchange or purchase. Will collect other orders in exchange. D. G. Shappirio, 4811 17th St., N.W., Washington 11, D. C.

Lepidoptera—Large quantities of Plexippus, Colias, Cardui, Vanillae wanted for cash or exchange for tropical butterflies. G. MacBean, 710 Miller Rd., Sea Island, Vancouver, B. C.

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